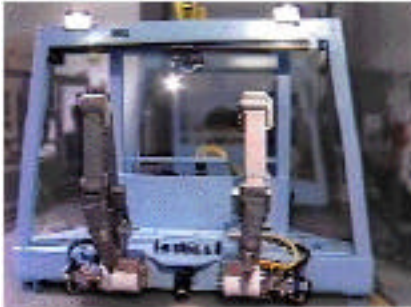




## Dual Arm Work Platform (DAWP)



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### Technology Need

Throughout the Department of Energy (DOE) complex there are numerous facilities which were constructed to research and develop nuclear materials during the cold war era. As a result, there are now many facilities such as reactors which require dismantlement and clean up. Technological advances over the past 10 years have significantly increased the capabilities of computers, electronics and automated machinery. Because of these rapid advances, the use of robotic and remote systems will increase to protect people from exposure to hazardous environments.

The Dual Arm Work Platform (DAWP) combined work done at Oak Ridge National Laboratory on a dual arm work module with work done at INEEL on an innovative stereo vision system, the Virtualwindow. The DAWP design was focused on dismantlement of the CP-5 reactor at Argonne National Laboratory near Chicago, Illinois.

### Technology Description

The design of the DAWP was driven by specific facility and task requirements. Less than three months were allotted to define requirements and explore design concepts, and the DAWP was designed and built in less than seven months. The equipment had to provide maximum overall

capability and yet be functional while operating in a very confined space. One of the primary operating environments for the DAWP was within a ten foot diameter steel cylinder which forms the boundary between the reactor and its bioshield. Within this cylinder the equipment had to perform a variety of tasks including bolt removal, pipe cutting, reactor vessel dismantlement, and disassembly of thousands of fitted graphite blocks. Very early on it was decided that two manipulator arms would be used because many of these dismantlement tasks would require two arms working cooperatively in the same area to accomplish the work effectively. The manipulator arms were mounted side by side and 36 inches apart. The base of the manipulator arms mount to actuators that provide two additional degrees of freedom so that the manipulator arms can reach anywhere within the ten foot cylinder. This configuration was closely modeled after the Oak Ridge National Laboratory dual arm system. The arm/actuator assemblies were mounted on an epoxy-coated carbon steel structure to form the Dual Arm Work Platform.

The DAWP is positioned within the reactor facility by either a forklift or an overhead crane. All functions of the DAWP, including manipulator operation, actuator operation, lighting control, tool control, and operation of the Virtualwindow, are performed by an operator located in a control room approximately 70 feet from the reactor through 175 feet of tether.

The DAWP is designed to be self contained such that all cameras, lighting, and dismantlement tools are located on the platform. (See the Virtualwindow white paper for a complete description of how the Virtualwindow works.) The DAWP has five electrical tool ports and two

hydraulic tool ports. For CP-5, the tools used on the DAWP have been primarily off-the-shelf industrial tools with minor modifications to allow the manipulators to hold them.



### Technology Status

The DAWP, along with its ORNL control system and operator station, was delivered to the CP-5 site in December, 1996. Starting in February, 1997 the DAWP was used on nearly a daily basis. As of August 1998 the DAWP had successfully removed almost 60,000 lbs. of graphite blocks, 1400 lbs. of lead sheeting, 620 lbs. of boral, and 2000 lbs. of carbon steel. It size reduced and dismantled the aluminum reactor tank (following hundreds of linear feet of cuts through 3/8" – 1/2" aluminum plate), and removed the resultant 1700 pounds of aluminum plate from the reactor.

Intermittent problems with the hydraulic manipulators and the use of off-the-shelf tools have caused minor delays, but overall the system has been very functional and reliable. Its initial mission is now complete and several possible new missions for the DAWP are being investigated.

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